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EXAMINER	
DIETERLE, JENNIFER M	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/585,263	JIANG ET AL.	
	Examiner	Art Unit	
	Jennifer Dieterle	4111	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/18/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

Claims 1-13 are pending and are being examined.

Claim Objections

1. Claim 8 is objected to because of the following informalities: Claim 8 depends on claim 7, but should depend from claim 1. The language in claim 8 does not further limit claim 7 and is a different structure than claim 7 and lacks antecedent basis. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites the limitation of "at least two redox systems." First, redox is shorthand for a reduction-oxidation reaction. A redox system is defined as a chemical reaction in which a first chemical species is oxidized and a second chemical species is reduced.

Applicants' specification at paragraphs [0049-50] describes a chemical process wherein the redox system comprises the AQC species and hydrogen ions. At paragraphs [0053-0054], Applicants' specification describes a redox system comprising DPPD and hydrogen ions. No support is found for a "redox system," or for multiple "redox systems." It appears that the redox reactions occur between chemical species present on an electrode surface and species present in the fluid under investigation.

It appears that the term "redox system" refers to a molecule such as anthraquinone (AQC) or N,N'-diphenyl-p-phenylenediamine (DPPD), but could include any molecule that can easily be oxidized or reduced. Additionally, those claims dependent on claim 1 are also subject to this rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Casimari et al. (*Co-immobilized L-lactate oxidase and L-lactate dehydrogenase on a film mounted on oxygen electrode for highly sensitive L-lactate determination*, Biosensors & Bioelectronics, 1995, Vol. 11, No. 8, pages 783-789).

Regarding claim 1, Casimari et al. teach an electrochemical sensor comprising at least two redox active molecule (i.e. L-lactate oxidase (LOD) with L-lactate dehydrogenase (LDH); see abstract). Both are redox active molecules and both are immobilized on an electrode and both are sensitive to the same species (i.e. L-lactate).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-6, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wrighton et al. (US 5,223,117) in view of Wildgoose et al. (*Anthraquinone-derivatised carbon powder: reagentless voltammetric pH electrodes*, Talanta, 60, 2003, pages 887-893) and Pandurangappa et al. (*Physical adsorption of N,N'-diphenyl-p-phenylenediamine onto carbon particles: Application to the detection of sulfide*, Analyst, 2003, 128, 473-479).

Regarding claims 1, 5 and 6, Wrighton et al. teach an electrochemical sensor comprising:

- At least one redox active molecule (figure 1; 16&18; col. 3, lines 1-4; figure shows 2 molecules)

[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." See *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968); MPEP 2144.01. Examiner recognizes that Wrighton et al. in its examples teach the use of a pH sensitive molecule and a CO sensitive molecule which are each sensitive to a different species. However, while Wrighton et al. in its examples teach molecules that are different to different species, Wrighton et al. does not eliminate the possibility or provide any indication that a combination of two pH sensitive or two CO sensitive redox molecules on an electrode will not function. In fact, Wrighton et al. lists several pH sensitive and multiple CO

sensitive redox molecules that can be utilized on an electrode (col. 4, lines 30-37). It would be obvious to one skilled in the art to utilize any or several of these redox molecules on an electrode since Wrighton et al. does teach that more than one redox molecule can be placed on an electrode (col. 3, lines 1-5).

Additionally, Wildgoose et al. teach a pH sensor in which anthraquinone species (i.e. redox molecule) is derivatized with carbon powder and screen-printed on a BPPG electrode (page 887 - Introduction; page 888, col. 2, section 2.3, 1st paragraph) to produce a cheap and simple to use pH sensor (page 892, Conclusion). Additionally, Wildgoose et al. teach a reagentless sensor which offers better stability and less recalibration than historic (glass electrode, membrane) pH devices (page 887, Introduction).

Pandurangappa et al. teach the same BPPG electrode onto which N,N'-diphenyl-p-phenylenediamine (DPPD) (i.e. redox molecule) is derivatized (page 473, col. 2). While the article specifically speaks to the use of this electrode for the detection of sulfide, it is clear from the chemical formula of DPPD on page 475 that it is capable of redox reaction through the gain/loss of hydrogen ions (i.e. be used to detect pH).

Additionally, it is known based on the chemical properties of anthraquinone and DPPD that both species undergo two-electron two-proton redox processes over a wide pH range.

Therefore, it would be obvious to try placing two redox molecules sensitive to the same species on an electrode with a reasonable expectation of success. (See *KSR*, 550 U.S. at ___, 82 USPQ2d at 1396; MPEP 2141 III E). Since Pandurangappa et al.

and Wildgoose et al. both teach the use of a redox molecule that is capable of being sensitive to pH (i.e. hydrogen ions) and both capable of being fixed to a carbon powder based electrode, and since Wrighton et al. teach the use of two redox molecules on an electrode, it would have been obvious to try and modify the redox molecules of Wrighton et al. so that two pH sensitive or two CO sensitive molecules (which are sensitive to the same species) are placed onto an electrode with a reasonable expectation of success.

Regarding claim 2, Wrighton et al. teach a sensor capable of measuring pH (col. 2, line 9). Since a proton is a hydrogen ion (H+) and a pH sensor has a redox active compound that is sensitive to the concentration of protons (i.e. H+). By definition pH is the negative logarithm of H+ concentration to the base 10. Therefore, since the sensor of claim 1 is a pH meter the species are protons.

Regarding claim 3, Wrighton et al. teach the use of one or more redox reagents (col. 4, lines 30-55), therefore, each reagent will have a maximum or peak redox reaction at different voltages (see figure 4a-d).

Regarding claim 4, Wrighton et al. teach that the at least two redox molecules are mounted onto the same conductive substrate (i.e. a AU substrate 12 that carries molecules M and R; figure 1a; col. 3, lines 1-18; NOTE: Applicants' in their specification paragraph [0045] acknowledge this prior art teaching).

Regarding claim 9, the subject matter of a properly construed claim is defined by the terms that limit its scope. It is this subject matter that must be examined. As a general matter, the grammar and intended meaning of terms used in a claim will dictate

whether the language limits the claim scope. Language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation. The following are examples of language that may raise a question as to the limiting effect of the language in a claim:

(A) statements of intended use or field of use,

(B) "adapted to" or "adapted for" clauses,

(C) "wherein" clauses, or

(D) "whereby" clauses. (MPEP 2106 II, C, 2144.04).

Therefore, claim 9 uses the phrase "adapted to" which do not further limit the structure of the device. Hence, these limitations do not further define the actual structure of the sensor, but merely set forth the intended use of the sensor and need not be given further due consideration in determining patentability of an apparatus.

Additionally, it is inherent in Wrighton et al. that there is some type of detecting device with the sensor since graphs are provided as figures and these graphs would require a detecting device in order to be compiled.

Regarding claim 10, claim 1 above discusses the redox system, but does not discuss the voltage supply, electric current or analyzer. Wrighton et al. teach all of these as follows:

- A voltage supply and electric current detector (abstract, since the device is a voltammetric microsensor it is inherent there be a voltage supple and since a measuring potential is determined a detector is inherent).

Additionally, see votammogram figures 4a-d which would not be possible without a voltage supplying a current and a detector to produce the graph; and

- An analyzer. See figure 5 showing the use of derivatives to establish the differences in the peak positions which is done electronically, i.e. inherent analyzer (col. 8, lines 45-53).

With respect to the voltage supply "performing measurements" and the analyzer "detecting shifts," these limitations do not further define the structure of the electrochemical sensor, but only specify how the voltage supply and analyzer are intended to be used. Hence, these limitations do not further define the actual structure of the sensor, but merely set forth the intended use. Intended use need not be given further due consideration in determining patentability of an apparatus.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wrighton et al. (US 5,223,117), Wildgoose et al., and Pandurangappa et al. in view of Kuo et al. (*Electrochemical modification of boron-doped chemical vapor deposited diamond surfaces with covalently bonded monolayers*, Electrochemical and Solid-State Letters, 2 (6), 1999, 288-290).

Regarding claim 7, Wrighton et al. teach an electrochemical sensor, but does not teach the use of diamond-based substrate.

Kuo et al. teach a diamond-based substrate for use in electrochemical applications requiring low background current, side potential window and excellent stability and facile electron transfer to redox systems (page 288, col. 1, first paragraph).

Therefore, it would have been obvious to one skilled in the art to modify the carbon power electrode of Wrighton et al. to be a carbon nanotube as taught by Kuo et al. because diamond-based substrates are stable and provide facile electron transfer in order to facility redox activity (i.e. pH) (page 288, col. 1, first paragraph).

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wrighton et al. (US 5,223,117), Wildgoose et al., Kuo et al. and Pandurangappa et al. in view of Wang et al. (*Carbon nanotube screen-printed electrochemical sensors*, Analyst, 2003, 129, 1-2).

Regarding claim 8, Wrighton et al. teach an electrochemical sensor, but does not teach the use of carbon nanotubes.

Wang et al. teach an electrochemical sensor in which carbon nanotubes are utilized and have a well defined appearance, are mechanically stable, and exhibit high electrochemical reactivity (page 1, col. 1, 1st paragraph).

Therefore, it would have been obvious to one skilled in the art to modify the carbon power electrode of Wrighton et al. to be a carbon nanotube as taught by Wang et al. because carbon nanotubes have well defined appearance, are mechanically stable, and exhibit high electrochemical reactivity (page 1, col. 1, 1st paragraph).

7. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wrighton et al. (US 5,223,117), Wildgoose et al., and Pandurangappa et al. in view of Diakonov et al. (US 2003/0206026 A1).

Regarding claim 11-13, Wrighton et al. teach a tool for measuring effluents as stated in claim 1 above, but does not teach the use of the device as a downhole tool.

Diakonov et al. teach a sensor for wellbore applications (paragraph [0002]). Diakonov et al. teach that it is known in the art to have sensors permanently or quasi-permanently installed in a wellbore (paragraph [0003]) as part of a control system for wellbores in order to understand water chemistry to save costs and increase production during exploration (paragraph [0005]). Diakonov et al. teach that some parameters of species in well environment change significantly while on a trip to the surface and that pH, and CO2 are among the most critical parameters for corrosion and scale assessment so it is important to know their downhole values precisely (paragraph [0011]).

Therefore, it would have been obvious to one skilled in the art to modify the device of Wrighton et al. to be used in a well environment, either permanently or quasi-permanently installed, as a downhole sensor as taught by Diakonov et al. because knowing the pH and other parameters help to detect corrosion and scale assessment (Diakonov et al. paragraph [0011]) and help to save costs and increase production (paragraph [0005]).

A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to

patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. (See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458,459 (CCPA 1963); MPEP 2111.02).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer Dieterle whose telephone number is (571) 270-7872. The examiner can normally be reached on Monday thru Friday, 8am to 5pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Sines can be reached on (571) 272-1263. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMD
8/10/09

/Brian J. Sines/

Supervisory Patent Examiner, Art Unit 1795